Agency for Healthcare Research and Quality
Advancing Excellence in Health Care

NATIONAL GUIDELINE CLEARINGHOUSE

General

Guideline Title

ACR Appropriateness Criteria® acute hand and wrist trauma.

Bibliographic Source(s)

Bruno MA, Weissman BN, Kransdorf MJ, Adler R, Appel M, Beaman FD, Bernard SA, Fries IB, Khoury V, Mosher TJ, Roberts CC, Scharf SC, Tuite MJ, Ward RJ, Zoga AC, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness CriteriaÂ® acute hand and wrist trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2013. 13 p. [60 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Rubin DA, Daffner RH, Weissman BN, Bennett DL, Blebea JS, Jacobson JA, Morrison WB, Resnik CS, Roberts CC, Schweitzer ME, Seeger LL, Taljanovic M, Wise JN, Payne WK, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® acute hand and wrist trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2008. 9 p.

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Acute Hand or Wrist Trauma

Variant 1: Wrist trauma, first examination.

Radiologic Procedure	Rating	Comments	RRL*
X-ray wrist	9		
CT wrist without contrast	1		
CT wrist with contrast	1		
CT wrist without and with contrast	1		
MRI wrist without contrast	1		O
MRI wrist without and with contrast	1		O

Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | *Relative

Radiologic Procedure	Rating	Comments	RRL*
Tc-99m bone scan wrist	1		
US wrist	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Suspect acute distal radius fracture. Radiographs normal. Next procedure.

Radiologic Procedure	Rating	Comments	RRL*
Cast and repeat x-ray wrist in 10-14 days	8		
MRI wrist without contrast	8		O
CT wrist without contrast	7		
MRI wrist without and with contrast	1		O
CT wrist with contrast	1		
CT wrist without and with contrast	1		
Tc-99m bone scan wrist	1		
US wrist	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Comminuted, intra-articular distal radius fracture on radiographs. Surgical planning.

Radiologic Procedure	Rating	Comments	RRL*
CT wrist without contrast	9	This procedure is especially useful if 3-D reconstruction is available.	
MRI wrist without contrast	5	This procedure may be helpful to diagnose for ligament or soft-tissue injuries.	O
CT wrist with contrast	1		
CT wrist without and with contrast	1		
MRI wrist without and with contrast	1		O
Tc-99m bone scan wrist	1		
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Radiologic Procedure	Rating	Comments	RRL*
US wrist	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Suspect acute scaphoid fracture, first examination.

Radiologic Procedure	Rating	Comments	RRL*
X-ray wrist	9		
CT wrist without contrast	1		
CT wrist with contrast	1		
CT wrist without and with contrast	1		
MRI wrist without contrast	1		O
MRI wrist without and with contrast	1		O
Tc-99m bone scan wrist	1		
US wrist	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Suspect acute scaphoid fracture. Radiographs normal. Next procedure.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without contrast	9		O
Cast and repeat x-ray wrist in 10–14 days	8		
CT wrist without contrast	7		
Tc-99m bone scan wrist	3	This procedure may be useful with SPECT/CT.	
MRI wrist without and with contrast	1		O
CT wrist with contrast	1		
CT wrist without and with contrast	1		
US wrist	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation

Radiologic Procedure	Rating	Comments	RRL*

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 6: Suspected occult scaphoid fracture. Initial radiographs and repeat radiographs after 10–14 days of casting are normal. Continued clinical suspicion of scaphoid fracture. Next procedure.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without contrast	9		O
CT wrist without contrast	8		
Tc-99m bone scan wrist	4	SPECT/CT greatly enhances the utility of this procedure.	
MRI wrist without and with contrast	1		O
CT wrist with contrast	1		
CT wrist without and with contrast	1		
US wrist	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 7: Suspect distal radioulnar joint subluxation.

Radiologic Procedure	Rating	Comments	RRL*
X-ray wrist	9		
CT wrist without contrast bilateral	9	This procedure is especially useful if 3-D reconstruction is available. Bilateral wrist CT (pronated and supinated) is indicated.	
MRI wrist without contrast	5		O
CT wrist with contrast bilateral	1		
CT wrist without and with contrast bilateral	1		
MRI wrist without and with contrast	1		O
Tc-99m bone scan wrist	1		
US wrist	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 8: Suspect hook of the hamate fracture. Initial radiographs normal or equivocal.

Radiologic Procedure	Rating	Comments	RRL*
X-ray wrist additional views	9	Additional views such as hamate or carpal tunnel are indicated when using this procedure.	
CT wrist without contrast	9		
MRI wrist without contrast	5		O
CT wrist with contrast	1		
CT wrist without and with contrast	1		
Tc-99m bone scan wrist	1		
MRI wrist without and with contrast	1		O
US wrist	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 9: Suspect metacarpal fracture or dislocation.

Radiologic Procedure	Rating	Comments	RRL*
X-ray hand	9	Use this procedure for the initial study.	
CT hand without contrast	7	Use this procedure for surgical planning or if there is high suspicion and a negative radiograph.	
CT hand with contrast	1		
CT hand without and with contrast	1		
MRI hand without contrast	1		O
MRI hand without and with contrast	1		O
Tc-99m bone scan hand	1		
US hand	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 10: Suspect phalangeal fracture or dislocation.

Radiologic Procedure	Rating	Comments	RRL*
X-ray finger	9		
CT finger without contrast	2		
CT finger with contrast	1		
CT finger without and with contrast	1		
Tc-99m bone scan hand	1		
MRI finger without contrast	1		O
MRI finger without and with contrast	1		O
US finger	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 11: Suspect thumb fracture or dislocation.

Radiologic Procedure	Rating	Comments	RRL*
X-ray thumb	9	Consider this procedure for the initial study.	
CT thumb without contrast	5	Consider this procedure if radiographs negative and/or for surgical planning.	
MRI thumb without contrast	5	Consider this procedure if radiographs negative.	O
CT thumb with contrast	1		
CT thumb without and with contrast	1		
MRI thumb without and with contrast	1		O
Tc-99m bone scan hand	1		
US thumb	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 12: Suspect gamekeeper injury (thumb metacarpophalangeal ulnar collateral ligament injury).

Radiologic Procedure	Rating	Comments	RRL*
X-ray thumb	9		
MRI thumb without contrast	9		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative

Radiologic Procedure	Rating	Comments	RRL*
US thumb	8	Perform this procedure in specialized centers where the requisite level of expertise is available.	O
X-ray thumb with valgus stress and contralateral comparison	5	This procedure may be diagnostically appropriate but is a painful examination and puts the patient at risk for worsening injury. Recommend consultation with treating physician.	
MR arthrography thumb	2		O
MRI thumb without and with contrast	1		O
X-ray arthrography thumb	1		
CT thumb without contrast	1		
CT thumb with contrast	1		
CT thumb without and with contrast	1		
Tc-99m bone scan hand	1		
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

The hand and wrist are, arguably, the most active and complex components of the upper extremity, and, as such, are highly vulnerable to injuries with significant long-term consequences if diagnosis is delayed or incorrect. Hand and wrist fractures and fracture-dislocations are more common than those of any other part of the body. For most patients with trauma to the hand, wrist, or both, radiographs provide adequate diagnostic information and guidance for the treating physician. However, in one large study, wrist fractures, especially those of the distal radius and scaphoid, accounted for more delayed diagnoses than any other traumatized region in patients with initially normal emergency room radiographs. Thus, when initial radiographs are negative, or in the presence of certain clinical or radiographic findings, further imaging is appropriate. This may be as simple as additional radiographic projections, or it may include sonography, bone scintigraphy, computed tomography (CT), or magnetic resonance imaging (MRI). Sonography, in particular, has played a small role in the evaluation of acute hand and wrist trauma in the past but is increasingly utilized in the evaluation of acute hand and wrist trauma in specialized centers and has been demonstrated in recent studies to discriminate fine ligamentous structures stabilizing the wrist joints; however, such use requires a level of expertise that is not uniformly available. The use of sonography for the initial evaluation of acute hand and wrist injury and instability may therefore be appropriate in those centers where the requisite level of expertise is available.

Distal Radius Fracture

As is true for many joints of the extremities, a 2-view radiographic examination is not adequate for detecting fracture in the wrist, hand, or fingers. In most patients with suspected distal radius fractures, a 3-view radiographic examination (posteroanterior [PA], lateral, and 45º semipronated oblique) suffices, whereas one study suggests that the routine addition of a fourth projection—a semisupinated oblique projection—would increase the yield for distal radius fractures, which may be visible only on this fourth view. Nevertheless, when high-field or low-field MRI is performed in addition to radiographs, radiographically occult fractures of the distal radius as well as unsuspected fractures of the carpal bones are frequently demonstrated. In injured wrists with normal or suspicious radiographic findings that do not account for the clinical symptoms, MRI results in a change in diagnosis in 55% of cases and a change in management in 66% of cases. However, a randomized controlled trial showed that routine performance of an immediate, abbreviated, low-field MRI study in acutely injured wrists did not predict the need for further treatment any better than the combination of physical examination and radiography. Furthermore, there was no statistically significant difference in outcomes measures

—including quality of life, time lost from work, and total costs—with this strategy compared to performing radiographs alone. In addition to MRI, multidetector CT (MDCT) can show radiographically occult carpal fractures and exclude or confirm suspected fractures when initial radiographs are equivocal. MRI is a more appropriate modality to use before CT if there are no contraindications to MRI. CT has an important role in treatment planning when initial radiographs show a complex fracture-dislocation of the carpus.

Successful treatment of distal radius fractures is predicated on the re-establishment of radial length, inclination, and tilt, as well as the restoration of the articular surfaces. Specifically, the presence of a coronally oriented fracture line, die-punch depression, and more than 3 articular surface fragments may indicate the need for operative reduction. Less than 2 mm residual step-off of the distal radial articular surface is considered a congruent reduction necessary for good long-term outcome. Most patients with intra-articular fractures of the distal radius develop radiographic radiocarpal osteoarthritis that progresses over time, even when the original fracture was treated with open reduction and internal fixation; however, the development of radiographic osteoarthritis does not correlate with function even 15 years after initial injury. CT examination reveals involvement of the radiocarpal and distal radioulnar articular surfaces, intra-articular displacements and depressions, and comminution more accurately than radiographs.

Measurements of articular surface gap and step-off are more reproducible when performed by comparing CT to radiographs. For displacements >2 mm, there is poor correlation between radiographic and CT findings. Thus, in distal radius fractures where there is a high likelihood of intra-articular incongruence (e.g., fractures in young adults, which frequently result from high-energy impact loading), selective or even routine use of CT to supplement the standard radiographic examination is warranted. The distal radial articular surface is best evaluated by MDCT with multiplanar reformatted images; if MDCT is not available, direct sagittal images can be obtained, but the imaging process may be difficult if the patient has a cast or external fixator. The addition of 3-dimensional (3-D) surface-rendered reconstructions to the standard 2-dimensional (2-D) CT images may increase interobserver agreement and will change planned management of intra-articular distal radius fractures in up to 48% of cases. MRI also shows intra-articular extension of distal radius fractures more frequently than does radiography and demonstrates concomitant intra-articular soft-tissue injuries—predominantly tears of the scapholunate interosseous ligament—that may affect surgical treatment. However, current evidence suggests that MRI performed immediately at the time of injury has no added value for predicting whether additional treatment will be necessary for soft-tissue injuries. CT is recommended over MRI for surgical planning of complex, intra-articular distal radius fractures.

Distal Radioulnar Joint (DRUJ) Subluxation

The diagnosis of DRUJ subluxation is problematic. The symptoms and physical findings are often nonspecific, and the condition is difficult to confirm radiographically. Traumatic subluxation or dislocation of the DRUJ may occur as an isolated injury or be associated with other conditions. If optimum positioning of the wrist is not possible because of the injury or overlying cast, CT scanning is recommended. Both wrists should be scanned simultaneously in both pronated and supinated positions. Although this examination can also be performed with MRI, repositioning the patient and scanning both wrists is logistically more complex, more time-consuming, and less comfortable with MRI compared to CT.

Scaphoid Fracture

An additional fourth radiographic projection—an elongated PA view with approximately 30º of cephalad beam angulation and the wrist positioned in 10° to 15° of ulnar deviation—is routinely recommended whenever there is clinical suspicion of a scaphoid fracture. However, scaphoid fractures are notoriously difficult to see on initial radiographs (regardless of the views) and are radiographically occult in up to 20% of cases. Standard practice in patients with clinically suspected scaphoid fractures but normal initial radiographs is to apply a cast and to repeat the clinical evaluation and radiographs in 10 to 14 days when resorption at the fracture line may make previously occult fractures visible. If the repeat radiographs are still normal or equivocal at that time and there continues to be a strong clinical suspicion of scaphoid fracture, imaging with a second modality—bone scintigraphy, CT, or MRI—is indicated. There is little evidence favoring either scintigraphy or CT in this scenario, although a recent meta-analysis found that MRI is superior to scintigraphy for showing occult scaphoid fractures. A survey of worldwide institutions found that MRI is most commonly used in these cases, although many hospitals still perform CT or scintigraphy, and the choice of modality often depends on local preferences, expertise, and equipment.

The role of tomography, ultrasonography, scintigraphy, CT, and MRI (with standard equipment or a dedicated, extremity-only scanner) has been evaluated in uncertain cases of scaphoid fracture at the time of or shortly after the initial injury. If one or more of these studies is sufficiently sensitive and specific, presumptive casting can be eliminated in normal cases, and definitive care can be instituted earlier for fractures.

Bone scintigraphy, with either delayed images or blood pool images, can be used to identify or exclude radiographically occult scaphoid fractures, but this use of scintigraphy has been largely replaced by MRI, which is both more sensitive and more specific than scintigraphy. Scintigraphic false-positive diagnoses of carpal fractures occur due to bone contusions, osteoarthritis, avascular necrosis, and osteomyelitis, any of which may be radiographically occult. MRI evaluation for radiographically occult scaphoid fractures can be performed using high-field or low-field equipment, a whole-body imaging system and appropriate local coil, or a dedicated extremity MR scanner. Not only can MRI accurately show scaphoid fractures, but in cases where no scaphoid fracture is present, MRI often demonstrates other unsuspected fractures of the distal radius or carpus or soft-tissue injuries. In this role, MRI may be cost-effective, especially if immediate MR examination is performed in lieu of presumptive casting, if MRI is done with a limited protocol and at a reduced charge, and if the total cost of presumptive care, including productivity lost from work, is included in the analysis. One recent study suggested that MRI should be used as the "reference standard" for suspected scaphoid fractures, since their study showed the specificity of MRI to be quite high, at 96%; however, this opinion is not universally held. Another recent study rated the positive predictive value of MRI for scaphoid fracture at only 88%.

Ultrasonography with high-frequency transducers can identify some cases of radiographically occult scaphoid fractures; however, the current evidence does not support the routine use of sonography in these cases outside of specialized centers where the appropriate level of expertise is available. Ultrasound (US) is not sensitive enough to preclude presumptive casting when no fracture is seen. Furthermore, US only interrogates the dorsal scaphoid waist, whereas a large proportion of wrists with clinically suspected occult scaphoid fractures in reality have a fracture of the distal radius or other carpal bone (or another portion of the scaphoid); all these cases would be missed if a negative US examination were used as the basis to avoid casting. CT examination is more sensitive and specific than scintigraphy for diagnosing radiographically occult scaphoid fractures, though it is less sensitive (and shows fewer additional fractures) than MRI in such a situation. Nevertheless, CT is a reasonable alternative to immediate MRI with a claustrophobic patient or when there is a contraindication to MRI.

Accuracy for scaphoid fracture detection is 99% for MRI, 98% for CT, 93% for bone scintigraphy, and 92% for sonography, although the number of patients studied were relatively few.

In summary, radiographically occult scaphoid fractures are relatively common and cause future morbidity when missed. In patients with a strong clinical suspicion of a scaphoid fracture but normal radiographs, either presumptive casting with repeated radiographs in 10 to 14 days or immediate MRI are equally acceptable strategies. The choice will depend on the age of the fracture, hand dominance, activity level of the patient, the availability of MRI, and local preferences. If repeat radiographs are normal, the patient remains symptomatic, and further imaging is required, MRI is the study of choice. For patients with contraindications to MRI, CT is preferred to scintigraphy. Sonography may be an appropriate alternative in those centers where the appropriate level of expertise is available.

For the scaphoid bone, not only is identification of the fracture important, but many surgeons also recommend immediate operative intervention for displaced scaphoid fractures. As little as 1 mm of displacement is important, resulting in a higher rate of nonunion and avascular necrosis. Although CT scanning confined to the direct sagittal plane will underestimate radial or ulnar displacement of scaphoid fractures, evaluations with MRI or multiplanar and/or 3-D reconstructions from MDCT are more sensitive than standard radiographs for showing small amounts of displacement. In cases where malposition of the scaphoid fracture fragments is suspected despite normal radiographs, CT is recommended. Similarly, CT examination is recommended when there is a question about the age of a scaphoid fracture or its healing.

Hook of the Hamate Fracture

Compared with the scaphoid, the diagnosis of other carpal bone injuries is less problematic. In specific circumstances, however, supplemental studies in addition to the standard wrist examination are useful. Pisiform fractures are best seen on semisupinated AP or carpal tunnel projections, which project the pisiform volar to the rest of the carpus.

The same projections may also demonstrate fractures involving the hook of the hamate that are not visible on the standard radiographs. However, if radiographs fail to show a hamate fracture that is strongly suspected clinically, axial CT examination is indicated.

Metacarpal and Phalangeal Fracture

A standard 3-view radiographic examination will reveal most fractures and dislocations of the metacarpals and phalanges. CT may be useful for surgical planning in fracture-dislocations of the carpometacarpal joints. For phalangeal injuries, some practices include a PA examination of the entire hand, whereas others limit the entire examination to the injured finger. An internally rotated oblique projection in addition to the standard externally rotated oblique may increase diagnostic confidence for phalangeal fractures. Unlike the case for the wrist, low-field MRI is less sensitive than radiographs for hand and finger fractures, and its role is limited to cases where specific abnormalities of the soft tissues—including the collateral ligaments, volar plates, tendons, and pulleys—would affect treatment.

Thumb Fracture

Most fractures of the thumb will be visible on a 2-view radiographic examination, although there is a slight increase in diagnostic yield with the addition of an oblique projection, which can be obtained along with a PA examination of the whole hand. Tears of the ulnar collateral ligament of the thumb metacarpophalangeal joint (gamekeeper injury) represent a special problem. Unless there is an associated bony avulsion of the distal metacarpal or proximal phalangeal base, the injury will be radiographically occult. In these cases, a stress examination of the joint with manually applied abduction stress (which can be applied by the patient or the examiner) may show subluxation compared to the contralateral, uninjured side, although there is a theoretical risk of converting a nondisplaced ulnar collateral ligament tear into a displaced one by a stress examination. More important for treatment planning is whether the adductor aponeurosis has become interposed between the torn, displaced ligament and its osseous attachment site—a so-called Stener lesion. Torn ligaments with a Stener lesion require operative repair, although most nondisplaced tears without an interposed aponeurosis will heal with conservative treatment. Conventional arthrography, US, MRI, and MR arthrography have each been advocated to distinguish ulnar collateral ligament tears with and without Stener lesions. The choice of which modality to use will depend on local availability and expertise.

Summary

- Radiographs should be the first imaging study in patients with acute wrist, hand, or finger injuries. The examination must include the correct radiographic projections, which in turn depend on an accurate, site-specific clinical history.
- Nondisplaced wrist fractures, especially those of the distal radius and scaphoid, may be radiographically occult initially; in cases where there is a strong clinical suspicion of a fracture despite normal radiographs, further evaluation with immobilization and repeat radiographs, CT, or MR imaging is indicated, depending on the clinical circumstances.
- CT has additional roles for evaluating the articular surfaces in intra-articular fractures and for detecting specific injuries, including fractures of the hook of the hamate, subluxations of the distal radioulnar joint, and fractures and dislocations of the metacarpal bases.
- For many indications, including scaphoid bone injuries and ligament injuries at the base of the thumb, MR imaging is the most sensitive examination.
- Sonography may also be appropriate in specialized centers, both in detection of fractures and evaluation of injuries to the stabilizing ligaments of the wrist.

Abbreviations

- 3-D, 3-dimensional
- CT, computed tomography
- MRI, magnetic resonance imaging
- SPECT, single-photon emission computed tomography
- Tc, technetium
- US, ultrasound

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
	<0.1 mSv	<0.03 mSv
	0.1-1 mSv	0.03-0.3 mSv
	1-10 mSv	0.3-3 mSv
	10-30 mSv	3-10 mSv
	30-100 mSv	10-30 mSv

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies".

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Acute hand and wrist trauma

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Emergency Medicine

Family Practice

Internal Medicine

Nuclear Medicine

Orthopedic Surgery

Radiology

Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of initial radiologic examinations for patients with acute hand and wrist trauma

Target Population

Patients with acute hand and wrist trauma

Interventions and Practices Considered

1. X-ray, wrist, hand, finger, or thumb
    - Cast and repeat x-ray wrist in 10-14 days
    - Additional views (wrist)
    - Thumb with valgus stress and contralateral comparison
    - Arthrography, thumb
2. Computed tomography (CT), wrist, hand, finger, or thumb
    - Without contrast
    - With contrast
    - Without and with contrast
    - Without contrast bilateral (wrist)

- With contrast bilateral (wrist)
- Without and with contrast bilateral (wrist)

3. Magnetic resonance imaging (MRI), wrist, hand, finger, or thumb
    - Without contrast
    - Without and with contrast
    - MR arthrography, thumb
4. Technetium (Tc)-99m bone scan, wrist, or hand
5. Ultrasound (US), wrist, hand, finger, or thumb

Major Outcomes Considered

- Quality of life
- Time lost from work
- Total costs
- Utility of radiologic examinations in differential diagnosis

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Procedure

Staff will search in PubMed only for peer reviewed medical literature for routine searches. Any article or guideline may be used by the author in the narrative but those materials may have been identified outside of the routine literature search process.

The Medline literature search is based on keywords provided by the topic author. The two general classes of keywords are those related to the condition (e.g., ankle pain, fever) and those that describe the diagnostic or therapeutic intervention of interest (e.g., mammography, MRI).

The search terms and parameters are manipulated to produce the most relevant, current evidence to address the American College of Radiology Appropriateness Criteria (ACR AC) topic being reviewed or developed. Combining the clinical conditions and diagnostic modalities or therapeutic procedures narrows the search to be relevant to the topic. Exploding the term "diagnostic imaging" captures relevant results for diagnostic topics.

The following criteria/limits are used in the searches.

1. Articles that have abstracts available and are concerned with humans.
2. Restrict the search to the year prior to the last topic update or in some cases the author of the topic may specify which year range to use in the search. For new topics, the year range is restricted to the last 10 years unless the topic author provides other instructions.
3. May restrict the search to Adults only or Pediatrics only.
4. Articles consisting of only summaries or case reports are often excluded from final results.

The search strategy may be revised to improve the output as needed.

Number of Source Documents

The total number of source documents identified as the result of the literature search is not known.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Strength of Evidence Key

Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis and results.

Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.

Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.

Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author drafts or revises the narrative text summarizing the evidence found in the literature. American College of Radiology (ACR) staff draft an evidence table based on the analysis of the selected literature. These tables rate the strength of the evidence (study quality) for each article included in the narrative text.

The expert panel reviews the narrative text, evidence table, and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the table. Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Rating Appropriateness

The appropriateness ratings for each of the procedures included in the Appropriateness Criteria topics are determined using a modified Delphi methodology. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. American College of Radiology (ACR) staff distribute surveys to the panelists along with the evidence table and narrative. Each panelist interprets the available evidence and rates each procedure. The surveys are completed by panelists without consulting other panelists. The appropriateness rating scale is an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate"; 4, 5, or 6 are in the category "may be appropriate"; and 7, 8, or 9 are in the category "usually appropriate." Each panel member assigns one rating for each procedure for a clinical scenario. The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating.

If consensus is reached, the median rating is assigned as the panel's final recommendation/rating. Consensus is defined as eighty percent (80%) agreement within a rating category. A maximum of three rounds may be conducted to reach consensus. Consensus among the panel members must be achieved to determine the final rating for each procedure.

If consensus is not reached, the panel is convened by conference call. The strengths and weaknesses of each imaging procedure that has not reached consensus are discussed and a final rating is proposed. If the panelists on the call agree, the rating is proposed as the panel's consensus. The document is circulated to all the panelists to make the final determination. If consensus cannot be reached on the call or when the document is circulated, "No consensus" appears in the rating column and the reasons for this decision are added to the comment sections.

This modified Delphi method enables each panelist to express individual interpretations of the evidence and his or her expert opinion without excessive influence from fellow panelists in a simple, standardized and economical process. A more detailed explanation of the complete process can be found in additional methodology documents found on the ACR Web site (see also the "Availability of Companion Documents" field).

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

The guideline developers reviewed published cost analyses.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of patients with acute hand and wrist trauma

Potential Harms

Relative Radiation Level (RRL)

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Bruno MA, Weissman BN, Kransdorf MJ, Adler R, Appel M, Beaman FD, Bernard SA, Fries IB, Khoury V, Mosher TJ, Roberts CC, Scharf SC, Tuite MJ, Ward RJ, Zoga AC, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness CriteriaÂ® acute hand and wrist trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2013. 13 p. [60 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

1998 (revised 2013)

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Musculoskeletal Imaging

Composition of Group That Authored the Guideline

Panel Members: Michael A. Bruno, MD (*Principal Author*); Barbara N. Weissman, MD (*Panel Chair*); Mark J. Kransdorf, MD (*Panel Vice-chair*); Ronald Adler, MD, PhD; Marc Appel, MD; Francesca D. Beaman, MD; Stephanie A. Bernard, MD; Ian Blair Fries, MD; Viviane Khoury, MD; Timothy J. Mosher, MD; Catherine C. Roberts, MD; Stephen C. Scharf, MD; Michael J. Tuite, MD; Robert J. Ward, MD; Adam C. Zoga, MD

Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Rubin DA, Daffner RH, Weissman BN, Bennett DL, Blebea JS, Jacobson JA, Morrison WB, Resnik CS, Roberts CC, Schweitzer ME, Seeger LL, Taljanovic M, Wise JN, Payne WK, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® acute hand and wrist trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2008. 9 p.

Guideline Availability

Electronic copies: Available from the American College of Radiology (ACR) Web site .

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site .
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2013 Apr. 1 p. Electronic

copies: Available in PDF from the ACR Web site .

- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 2013 Apr. 1 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria® acute hand and wrist trauma. Evidence table. Reston (VA): American College of Radiology; 2013. 20 p. Electronic copies: Available in PDF from the ACR Web site .

Patient Resources

None available

NGC Status

This summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer as of June 29, 2001. This summary was updated by ECRI on July 31, 2002. The updated information was verified by the guideline developer on October 1, 2002. This NGC summary was updated by ECRI on January 4, 2006. The updated information was verified by the guideline developer on January 19, 2006. This summary was updated by ECRI Institute on June 25, 2009. This NGC summary was updated by ECRI Institute on February 27, 2014.

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